SCIENCE

NEW SERIES
VOL. 98, No. 2553

FRIDAY, DECEMBER 3, 1943

SUBSCRIPTION, $6.00
SINGLE COPIES, .15

Science: published weekly by The Science Press, Lancaster, Pa.

Entered as second-class matter July 18, 1923, at the Post Office at Lancaster, Pa., under the Act of March 3, 1879.

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VOL. 98 FRIDAY, DECEMBER 3, 1943 No. 2553

Emotions and Gastric Function: DR. HAROLD G. WOLFF 481

Petroleum, Past, Present and Future: DR. PER K. FROLICH 484

Obituary:
John Muirhead Macfarlane: DR. WALTER STECKBECK. *Recent Deaths* 487

Scientific Events:
Enlargement of the Laboratory Staff of the U. S. Forest Products Laboratory; The Pacific Map of the National Geographic Society; Destruction of the Berlin Herbarium; Meetings of Entomologists; The Informational Service of the Division of Medical Sciences of the National Research Council; Royal Society Medalists 489

Scientific Notes and News 492

Discussion:
Angiotonin or Hypertensin: DR. B. A. HOUSSAY and OTHERS. *The Triptane Process:* DR. VLADIMIR HAENSEL and PROFESSOR V. N. IPATIEFF. *Concerning Translations of Geological Texts for South American Students:* DR. WARREN D. SMITH 495

Scientific Books:
Chemical Spectroscopy: DR. L. G. S. BROOKER. *Temperature:* DR. ROBERT B. SOSMAN 496

Special Articles:
Desthiobiotin: PROFESSOR VINCENT DU VIGNEAUD and OTHERS. *Rations for the Study of the Relative Nutritive Value of Fats and Oils:* PROFESSOR E. B. HART and OTHERS 497

Scientific Apparatus and Laboratory Methods:
The Fractional Cephalin-Cholesterol Flocculation Test: DR. I. ARTHUR MIRSKY and RUBY VON BRECHT. *A Technique for Differentiating the Cells of the Pituitary of the Rat:* MIRIAM REED 499

Science News 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington 25, D. C.

EMOTIONS AND GASTRIC FUNCTION[1]

By Dr. HAROLD G. WOLFF

CORNELL UNIVERSITY MEDICAL COLLEGE

REVIEWING the life histories of the patients with ulcers, Mittelmann and Wolff found that the patients had been subject to prolonged emotional turmoil, involving mainly conflict, anxiety, guilt, hostility and resentment.

During periods of experimentally induced anxiety, hostility and resentment, they found a rise in acidity and increased contractions in the stomachs of all the patients suffering from ulcer and in many of the normal subjects. Moreover, they were able to reverse this process and cause a decrease in acidity and motility by inducing in their patients feelings of contentment and well-being.

In all the patients with peptic lesions it was possible to demonstrate a chronological parallelism between the onset, recrudescence and course of gastroduodenal symptoms, and the occurrence of untoward emotional reactions. The situations that prompted these reactions were not necessarily dramatic or in the nature of crises, but, because of the existing emotional frame within which they occurred, they had important effects on the patients.

To demonstrate that the above-described emotional states were relevant to the gastroduodenal dysfunction and peptic ulcers in the particular patients studied, situations were experimentally created which induced destructive emotional reactions and precipitated symptoms when the patient was free of symptoms. Moreover, if such effects, symptoms and tissue defects already existed, all increased in intensity during such experimental procedures. On the other hand, in situations which engendered feelings of emotional security and assurance, gastric function was restored toward normal and symptoms eliminated, in those with symptoms and abnormal function.

The facts of this study emphasize the occurrence in the same individual of the aforementioned destructive emotions coupled with increased motility and secretion

[1] Delivered at the New York Academy of Medicine Graduate Fortnight, October 11, 1943.

and mucosal circulatory changes in the stomach and duodenum, followed by evidence of gastritis and duodenitis and ultimately actual ulceration. This sequence suggests that the increased secretion, increased motility and disturbed circulation, mucosal erosions and ulcerations are phases of the same process differing only in the amount of tissue destruction in the stomach and duodenum.

To further validate these views, an intensive investigation was made by Dr. Stewart Wolf and the speaker[2] of a man who afforded them an exceptional opportunity to visualize the inside of his stomach.

METHOD

The man, aged 56 at the time of the study, completely occluded his esophagus at the age of 9 by drinking scalding hot clam chowder. Since then, he has fed himself through a gastric fistula 3.5 cm in diameter, surgically produced shortly after the accident. It is his custom to put food into his mouth and, after tasting and chewing it, to expectorate it into an ordinary kitchen funnel inserted into his stoma. Through the stoma has protruded on his abdominal wall a collar of gastric mucosa essentially similar to that within the cavity of the stomach. The patient is in excellent health, has rare digestive complaints and is employed as a "diener" in the laboratory. He is a small, wiry man of Irish-American stock, unschooled, married and the father of one child. He is shy, sensitive, proud, stubborn and slightly suspicious. He is fun-loving but very conscientious.

Estimates of vascular changes were made.

The stomach was emptied every fifteen minutes and the juice obtained was titrated for free hydrochloric acid and total acid.

In many of the experiments, records of the stomach contractions were made.

Careful note was made of the patient's mood and the content of his thoughts and preoccupations. These data were collected during the experiments as well as at separate daily interviews. An attempt was made to classify the emotional and other reaction patterns as contentment, joy, gratitude, feelings of helplessness, dejection, doubt, fear, frustration, guilt, sadness, anxiety, tension, hostility and resentment. None of these existed alone, but usually it was possible to recognize one or two as dominant. The emotional reactions were then correlated with the various measurements of gastric function.

The emotionally charged situations were not experimentally induced. Spontaneously occurring life situations, problems and conflicts were utilized. Some of these involved events arising from time to time in the laboratory. Others occurred in the setting of the subject's home life. His reaction to each of these experiences was evaluated in the light of his individual personality pattern. Thirty-four observations on stomach function accompanying several different affective states were made. From these, illustrative examples will be presented.

[2] Human Gastric Function. Stewart Wolf and Harold G. Wolff. Oxford University Press, New York, 1943.

OBSERVATIONS

During the periods when the subject was relaxed and apparently contented, the color of the mucosa remained relatively constant. Contractions were usually of low amplitude and rhythmic, making a pattern of three small waves a minute.

Spontaneous Periodic Phases of Accelerated Gastric Function.—Every two to three hours, there occurred in the stomach a transitory phase of hyperemia, hypersecretion of acid and vigorous contractions. These followed a rather constant pattern and lasted only twenty to thirty minutes. After the phase of accelerated gastric function had subsided, the stomach assumed its former "basal" condition.

Depression of Gastric Function in Association with Fear and Sadness. Fear: The patient suddenly experienced intense fear one morning in the midst of a phase of accelerated gastric function. An irate doctor entered the room muttering imprecations about an important protocol which had been lost. The patient had mislaid it and feared he had lost the record and his job. He lay motionless on the table and his face became pale. Prompt and decided pallor occurred also in his gastric mucosa, and associated with it there occurred a fall in the rate of acid production. A minute later, the doctor found his paper and left the room. Forthwith the face and gastric mucosa of the patient regained their former color.

Sadness: Sadness, dejection and feelings of self-reproach were accompanied in this subject by taciturnity, lack of "energy," slowness of movement of the body generally and by pallor of the gastric mucosa, decreased acidity and motor activity. Even the stomach's normal response to the ingestion of food was inhibited under these circumstances.

One morning, the patient was depressed and uncommunicative over having lost, through his own negligence, an option on a house which he had long been eager to acquire. He was limp and dejected and filled with feelings of self-depreciation and refused to relate the nature of his trouble until several hours later. Beef broth was administered directly into his stoma and it was noted that the hyperemia and acceleration of acid production and motility, which regularly followed ingestion of beef broth, were partially inhibited.

Acceleration of Gastric Function in Association with Emotional Conflicts Involving Anxiety, Hostility and Resentment. During a period of "basal function" of

the stomach one-half hour after a spontaneous phase of accelerated function, a member of the staff entered the room to pay off and discharge the subject from a job he was doing for the doctor after hours in order to earn some extra money. The doctor had complained earlier that he was slow, ineffective and charged too much. The subject, who takes great pride in his conscientious attitude toward his duties, resented heartily these charges. When the physician told him he need not report for work any more, he accepted the rebuff politely, but quickly his stomach became red and engorged and soon the folds were thick and turgid. Acid production accelerated sharply and vigorous contractions began. This happened in spite of the fact that another spontaneous phase of accelerated gastric function was not to be expected for at least an hour and a half.

These changes were noted frequently in association with feelings of strong hostility and resentment on the part of the patient, and also with anxiety. It is noteworthy that these incidents occurred far more commonly than did those described earlier, in which there was an associated inhibition of secretion, motor activity and vascularity.

The degree and duration of the changes in gastric function were also roughly proportional to the intensity and duration of the emotional reaction.

An illustration of prolonged acceleration of gastric function is as follows: The patient was usually in a state of comparative financial insecurity, and because of this he was compelled to accept gifts from a certain benefactor. The latter meddled in the subject's personal affairs and when denied a hand in managing them, threatened to withdraw support. During two weeks of such meddling, the patient became intensely anxious about his future welfare and resentful of the activities of his benefactor. He was eager to throw off his dependence. At the end of the two weeks, the opportunity for release came in the form of a raise in pay for his job at the hospital. This good fortune he received with the deepest feelings of relief.

Gastritis, Pain and Mucosal Erosions. In the presence of hypermotility and hypersecretion, the gastric mucous membrane not only became red but engorged and turgid as well.

During periods when his stomach was in this state, occurring as they did in association with emotional conflicts involving anxiety, hostility and resentment, the patient often complained of heartburn and abdominal pain. Indeed, it was possible to demonstrate experimentally that the tissues of the stomach wall were more sensitive to pain in their hyperemic state than normally. Vigorous contractions of a magnitude insufficient to cause pain in its normal state were painful when the stomach was intensely engorged.

Furthermore, the susceptibility of the mucosa to injury resulting in hemorrhage was found to be greatly enhanced in this condition of engorgement and hyperemia. Even relatively trifling traumas such as striking the membrane with a glass rod or stroking it with dry gauze resulted in small erosions and bleeding points. Frequently during periods of such hyperemia, vigorous contractions produced bleeding points around the periphery of the exposed collar of mucosa without the necessity of instrumentation.

Healing in the Stomach: The Protective Properties of Mucus. Ordinarily these small erosions and bleeding points which occurred from time to time were quickly covered with mucus and healed uneventfully in twenty-four hours or less. The failure of any of these lesions to persist as a chronic ulceration will be shown to be due largely to the effective protection afforded by the mucus.

When irritating substances such as mustard, strong acid or alkali were placed on the lining of the stomach without care being taken to remove the mucus coating, only a slight to medium erythema resulted. When the accumulation of protective mucus was continually aspirated away, however, and mustard was applied directly to the cells of the mucosa, acute inflammation and edema resulted. Bleeding points and small erosions appeared throughout the area involved. Pinching and faradic stimuli applied to the mucosa in this condition caused pain, although pain did not occur when these stimuli were applied to the mucosa in its normal state.

The protective powers of mucus have been shown to consist of three distinct mechanisms: First, it presented a continuous slippery surface to irritants. Second, by combining with and neutralizing the acid in immediate contact with it, it maintains the acidity of the stomach lining itself at a relatively low level. When a drop of Toepfer's solution was allowed to fall on the wall of the stomach, it failed to indicate an acid reaction despite the fact that a sample from a nearby pool of accumulated gastric juice contained 65 units of titratable free acid. An important aspect of this protective device is the fact that mechanical and chemical irritation of the gastric mucosa, as well as the presence of acid in high concentration in the stomach, accelerates the rate of production of mucus. Circumstances arose, however, when the amount of acid in the stomach exceeded the powers of this compensatory mechanism. Then the third protective property of mucus was invoked. The mucus precipitates and forms an insoluble, continuous, tough membranous coating over the cells of the gastric mucosa, thus insulating them from chemical attack.

Result of Continued Contact of Gastric Juice with a Mucosal Erosion. To demonstrate the effects of

contact of gastric juice with an eroded surface, the following experiment was conducted:

Two small bleeding points were produced in the gastric mucosa by traumatizing it with a smooth-edged forceps. These tiny eroded areas were kept in contact with gastric juice for one-half hour. The protective mucus which accumulated rapidly in this region was sucked away frequently and fresh gastric juice applied. A sharp acceleration of acid secretion and concomitant hyperemia of the whole gastric mucosa resulted from this procedure, and these effects persisted for one-half hour after the exposure of the erosions to the action of gastric juice had been stopped. After the undisturbed lesions had become covered by mucus, the color and acid values returned to normal.

This experiment supports the idea that the acceleration of acid secretion resulting from erosions being bathed in gastric juice is one mechanism involved in the maintenance of hyperacidity in patients suffering from peptic ulcer.

It can thus be shown that when an unprotected mucosal erosion is exposed to the digestive action of gastric juice, additional tissue damage occurs and chronic ulceration results.

COMMENT

The difference between a hypersecreting stomach and actual gastritis is, as has been shown, mainly one of degree. Prolongation of inordinate hypersecretion in the stomach with the inevitable accompanying hyperemia, then, carries with it the hazard of possible structural damage to the lining of the stomach or even more likely to that of the duodenal cap, since the latter is less well protected.

Once an erosion has been effected, contact of acid gastric juice with the denuded surface would perpetuate the vicious cycle as illustrated in the experiment described.

It has been shown that situational factors resulting in emotional conflict with anxiety, hostility and resentment may induce in the stomach profound and prolonged hyperemia, hypermotility and hypersecretion. Adequate neural mechanisms exist to explain these phenomena. The reason that the patient experimented with has not acquired peptic ulcer may be that the hyperemia and hypersecretion which were observed in the presence of conflict have been relatively transitory. He is not the sort of person who harbors grudges or maintains emotional stress for prolonged periods. Usually he expressed his feelings in words or in action, and his more serious conflicts were relatively short lived. Since the occurrence of gastric hyperfunction in certain emotional settings has been demonstrated, however, and since the destructive power of excessive gastric secretion has been established, one may infer that these emotionally charged situations are involved directly in the genesis of peptic ulcer in man. Hyperacidity, gastritis, minor mucosal erosions and finally peptic ulcer occurring during the course of sustained emotional tension should not be looked on as separate clinical entities. The evidence indicates that they are all phases of the same pathologic process.

PETROLEUM, PAST, PRESENT AND FUTURE. II

By Dr. PER K. FROLICH

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The domestically available energy source most closely related to crude oil is natural gas. The production and consumption of natural gas by states, although by no means identical to the distribution shown for crude oil in Fig. 9, follows much the same general pattern in that transportation by pipe line makes for a marked flexibility in distribution. To most of us it does not mean much when we are told that the country's proved natural gas reserves amount to some 95 trillion cubic feet.[11,12] A little figuring will show, however, that on a weight basis this is equal to about 75 per cent. of the proved reserves of petroleum. At the present rate of consumption the proved gas supply should last about thirty years, or twice as long as the oil supply. Methods are known for converting these natural gas hydrocarbons into liquid petroleum fractions. The heavier constituents can be processed by such direct methods as cracking or dehydrogenation, followed by polymerization and alkylation. Methane, however, which is the major constituent of natural gas, can best be converted into gasoline by the Fischer-Tropsch process. In that case the methane must first be reacted with steam to give a mixture of carbon monoxide and hydrogen, which is then treated with a catalyst to produce liquid hydrocarbons. Technical information is available on this process, but as yet this country has no large-scale operating experience. The process has been used commercially in Germany for some time, and a small pilot-plant unit for carrying out the Fischer-Tropsch

[11] Energy Resources Committee, "Energy Resources and National Policy," Rept. to Nat. Resources Comm., January, 1939.

[12] E. H. Poe, *Oil Gas Jour.*, July 28, 106, 1943.

ynthesis is now in operation at the Bureau of Mines.[13] t would be unwise at this time, however, to make any rediction in regard to the amount of gasoline that ight be produced in this manner.

A much larger potential supply of liquid hydrocarons is obtainable from the oil shales of the United States. Most important are the Tertiary oil shales of he Rocky Mountain region, located chiefly in Colo- ado and Utah. Other deposits are the Devonian black hales of Indiana and Kentucky and the cannel shales f Pennsylvania and West Virginia. In 1928 these shale deposits were estimated by Dean E. Winchester as capable of producing 92 billion barrels of oil.[14] Although this is still considered the most authoritative figure, a great deal of assay work must be done before an accurate estimate of practically available oil from shale can be made. It can definitely be said, however, that the potential supply of liquid hydrocarbons from this source is high compared with known crude oil reserves.

Oil is now being recovered from shales on a limited scale in various parts of the world by retorting under suitable conditions of temperature and pressure. From 1925 to 1929 the Bureau of Mines experimented with the recovery of oil from Colorado shales. Although no commercial scale production was undertaken, sufficient work was done to demonstrate the practicability of producing oil from this source. The oil obtained by retorting shale differs from conventional crude oil in that it has a higher percentage of unsaturated hydrocarbons, a lower percentage of gasoline, a higher wax content and relatively high content of phenolic compounds and nitrogen bases. Additional work therefore remains to be done on the development of satisfactory refining methods.[14,15]

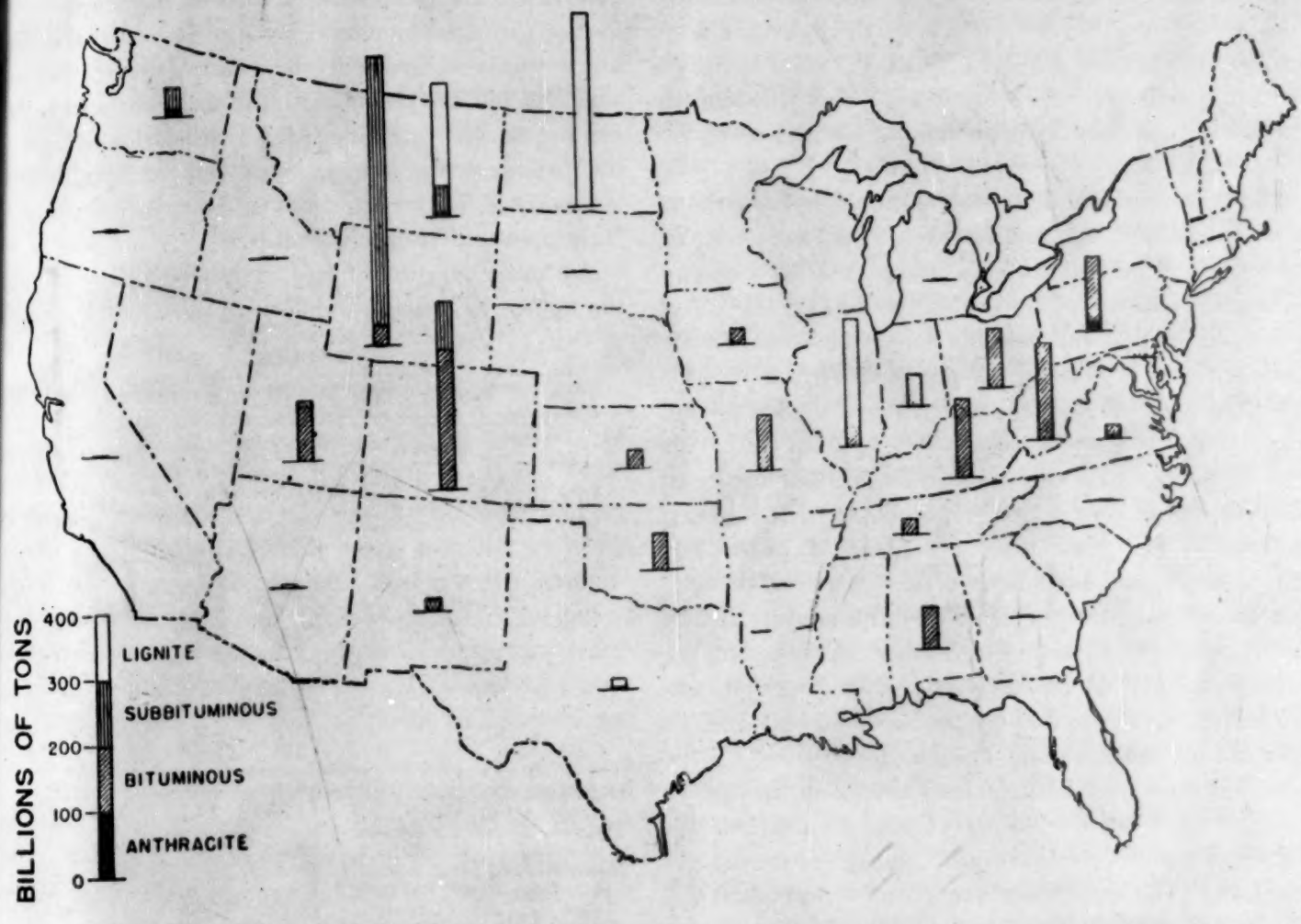

FIG. 12. Coal reserves by states as of January 1, 1937. Anthracite, subbituminous and lignite reduced to bituminous coal equivalent, according to "Energy Resources and National Policy."[11]

Beyond the borders of the United States, the Canadian deposits of tar sands can also be included. These deposits spread over thousands of square miles through the central portion of the Williston Basin in the Province of Alberta. They are composed of sands saturated with oil, and figures indicate the reserves of the Athabaska deposits to range from 100 billion barrels up to many times that quantity. Pratt gives an estimate of 100 to 250 billion barrels,[5] which places Ahabaska tar sand as one of the largest potential

[13] A. C. Fieldner, statement before Joint Committee on Public Lands and Surveys, U. S. Senate, August 4, 1943.

[14] Federal Oil Conservation Board, Rept. II, p. 13, January, 1928.

[15] B. H. Weil and W. Weinrich, *Oil and Gas Jour.*, April 22, 48, 1943; April 29, 73, 1943.

sources of petroleum in North America. However, the fact that these sands must be mined to extract their tar oil content presents practical difficulties. Of the total area, variously estimated at 10,000 to 50,000 square miles, not more than 10 square miles, containing perhaps 500 million barrels of oil, can be considered workable by strip mining methods.

Aside from the development work which remains to be done on improved methods of recovery and refining, the production of oil from the tar sands as well as from shale presents a problem in waste disposal. Even though this may not be a representative illustration, an oil recovery of 13 per cent. by weight may give approximately 1.5 cubic yards of solid material as waste per barrel of oil produced. This will tend to confine at least the initial processing operations to the point of mining.

The largest potential source of liquid hydrocarbons is, without doubt, our coal reserves. Coal accounts for more than 98 per cent. of the country's known energy resources, not including water power. (All water power, developed and suitable for development in the United States, would supply less than 25 per cent. of our present total energy requirements.) These coal deposits amount to more than 3 trillion tons. As Fig. 12 shows, almost 70 per cent. of the total coal reserves lies in the semiarid plains or in the Rocky Mountains, far from present centers of population and industry. About 85 per cent. of current production is from the 30 per cent. of our reserves east of the Mississippi River. The anthracite deposits are largely confined to Pennsylvania, with lesser quantities located in Virginia and Arkansas, and only smaller amounts in Colorado and Washington.[11]

Liquid fuels may be produced from coal by various methods such as low-temperature carbonization, the Fischer-Tropsch synthesis and high-pressure hydrogenation. The two latter are of most interest from the standpoint of yields obtainable. According to Petroleum Administrator Ickes, it is possible that some 50 million barrels of gasoline may now be made annually in Germany by high-pressure hydrogenation.[16] Coal has also been hydrogenated for some time in England on a less extensive scale. In this country the Bureau of Mines has in operation a laboratory-scale pilot plant for direct hydrogenation of coal,[13] and has been working on plans for the installation and operation of industrial-scale pilot plants. In recent hearings before a joint committee of Congress, Ickes strongly endorsed a proposal for the Government to build and operate larger-scale demonstration plants for the production of oil from coal. In his words, this "is a proposal to blaze the path now for private capital to do this job when we have no more natural domestic petroleum and it becomes a question of synthetic liquid fuel or the end of the gasoline age." There is no need at this time to go into further discussion of the quality of gasoline that may be produced by these various processes or the yields obtainable from different types of coals. According to Ickes' estimate, the available coal reserves can provide the synthetic fuel we need for a thousand years and still leave enough coal for other present-day purposes.[16]

This review has been concerned only with the available raw materials which have been handed down by nature through the ages. By growing vegetable matter it would undoubtedly be possible to extend these supplies, but the potentialities of this source of energy can not readily be estimated. A discussion of some of the technical and economic aspects of this problem is presented by Burke Jacobs in the report on "Energy Resources and National Policy."[11]

As to the question of cost, it may be well to consider the figures in Table 1 which were submitted by Farish before a House Committee last year.[17] These data indicate that gasoline from such alternate raw materials can be produced at a cost sufficiently close to present prices so that with an increasing cost of crude oil we may expect a gradual upward trend rather than any abrupt increase in the cost of gasoline and related products. In this connection, the petroleum

TABLE 1

COMPARISON OF METHODS FOR MOTOR GASOLINE PRODUCTION

Process	Approx. cost per barrel motor gasoline per day[a]	Approx. tons steel per barrel motor gasoline per day	Approx. gasoline cost, cents: Direct cost, including normal overhead but excluding depreciation	Approx. gasoline cost, cents: Total cost, including normal overhead and 10 per cent. depreciation
High-pressure coal hydrogenation	$12,800	14.1	15.9	22.6
Fischer, European design starting from coal	7,600	8.9	14.7	19.2
Fischer, European design starting from natural gas[b]	4,750	6.5	6.0	8.8
Modern high-pressure hydrogenation of petroleum[c]	1,150	1.4	4.8	5.5
Modern oil refinery, $1.20/bbl.[d]	700	0.7	5.1	5.3
Modern oil refinery, $2/bbl.[d]	700	0.7	8.3	8.5

[a] 1942 costs for complete plant including all utility supply and auxiliaries.
[b] Natural gas at 5 cents per 1000 cubic feet.
[c] Crude at $1.20 per barrel.
[d] Crude price at the well.

[16] H. L. Ickes, statement before Joint Committee on Public Lands and Surveys, August 3, 1943.

[17] W. S. Farish, hearings before Subcommittee of Committee on Mines and Mining, U. S. House of Representatives, July 15, 1942.

industry has not so far benefited by any appreciable increase in price level. Compared to August, 1939, the start of the present war, all commodities have increased 38.3 per cent., farm products 103.1 per cent., foods 61.2 per cent. and petroleum 19 per cent.[8] As Fig. 13 shows, the petroleum industry's record is one

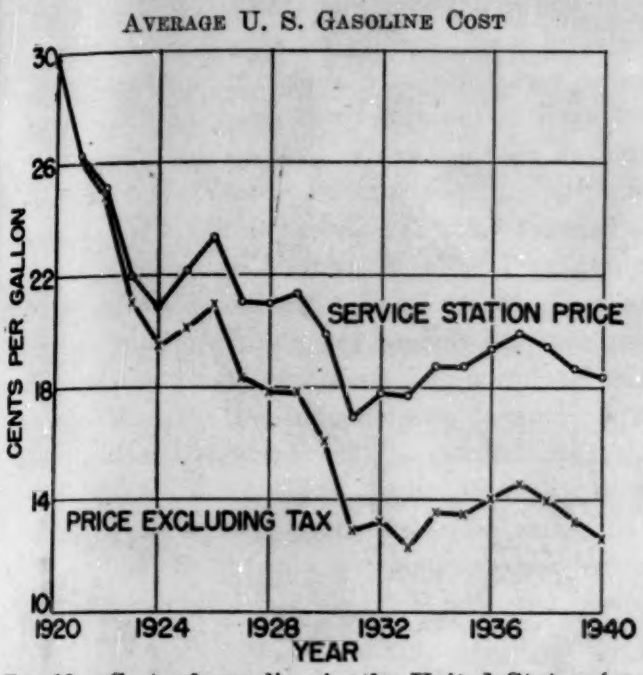

FIG. 13. Cost of gasoline in the United States (average for fifty cities.)

of decreasing costs brought about by technological improvements. This is particularly evident from the lower curve which represents the average gasoline cost in recent years, excluding the steadily mounting taxes. With a guaranteed supply of basic raw materials we should, in light of the petroleum industry's past achievements, be able to look with confidence toward the future.

It is not possible to predict the exact sequence of technical developments which lie ahead of us in this field. There is also a great deal of uncertainty in regard to the time element involved. New discoveries of crude reserves or an early termination of the war would undoubtedly relieve the present situation and delay the need for synthetic products; conversely, a prolonged war with continued heavy demands for petroleum would, in the absence of any substantial new discoveries, accelerate the need for alternate sources of supply. When the day comes, however, that the petroleum industry must turn in earnest to new sources of liquid fluids, its dependence on chemistry and engineering will become increasingly great. Whether the problem is one of recovering oil from shale, of liquefying natural gas, of working the tar sands or of hydrogenating or otherwise liquefying coal, chemistry and engineering will be called upon to work out processes which in major respects will differ from those currently in use by industry. We hardly need be concerned over the future of petroleum chemistry in general or even of the present trend toward utilization of petroleum as a chemical raw material, for these new processes will continue to yield the conventional hydrocarbons now obtained from crude oil and natural gas. In addition, such alternate processes are likely to increase the supply of hydrocarbon derivatives containing oxygen, sulfur and nitrogen which are being obtained from petroleum in such dilute concentrations that only in exceptional cases is their recovery a paying proposition.

This leads to the following general conclusions: In addition to the petroleum known to be present in the ground, large but as yet undiscovered reserves may be expected to exist in different parts of the world, including the United States. How long we can continue to locate this oil and bring it to the surface at the desired rate is an open question. At some future date, whether it be in the immediate future, in the next generation or in a much later generation, a shortage in natural petroleum will occur. In the meantime, there is nothing to indicate that this should result in any sudden change as far as our supply and consumption of gasoline and other petroleum derivatives are concerned. Progress will continue in the petroleum industry's efforts to improve the efficiency of its processes and the quality of its products. Advances in engine construction will make for better efficiency in the utilization of fuels and lubricants. Increased drilling on a world-wide basis will bring in more oil. There will be necessary adjustments in supply and demand so that oil will be moved freely from the principal centers of production to the principal centers of consumption. All this will tend to prolong the necessity, at least in time of peace, for turning to alternate sources of supply. As the need arises, synthetic products from the sources indicated will then gradually work their way into the picture.

OBITUARY

JOHN MUIRHEAD MACFARLANE

September 28, 1855—September 16, 1943

JOHN MUIRHEAD MACFARLANE, professor emeritus of botany at the University of Pennsylvania, died at his summer home, Lancaster, N. H., on September 16, twelve days before attaining his eighty-eighth birthday. He was born at Kircaldy, Scotland, and received the B.S. and D.Sc. degrees from the University of Edinburgh, where he held various academic positions, including that of professor in the Royal Veterinary College. In 1891 he was invited to speak before the American Association for the Advancement of

Science on insectivorous plants, especially on Dionaea. While in this country he was invited to a professorship in biology at the University of Pennsylvania; he accepted and in 1893 became professor of botany, a position held until his retirement in 1920.

Through the untiring and unremittant efforts of Dr. Macfarlane as head of the botany department and director of the botanic garden over a period of twenty-seven years great advances and constructive improvements were wrought, both for the cause of botany at the university and for the general field of this science. From "extended vistas of sand-hills and gravel hollows" there was evolved a well-balanced and highly useful botanic garden. From a shelf with seventeen volumes on botany in 1893 there emerged a well-stocked botanic library with more than five thousand volumes. Greenhouses were erected and filled with a large and representative collection of plants. Laboratories were equipped with essential apparatus. The faculty was enlarged and the student body greatly augmented from time to time, with five hundred students taking courses in botany in 1920. Dr. Macfarlane believed in the influence and usefulness of subsidiary organizations that would serve to bring the alumni of the university and the general public in contact with the botanical department of the university. With this aim in view he founded the Botanical Society of Pennsylvania in 1897. This organization, which very soon included 150 members, has continued to the present and held the founder's interest and guidance to the end of his long life. The Graduate Botanical Club, organized about the same time, served to unite faculty, graduate students and graduates in their common interests. At the bi-weekly meetings results of investigations were reported and botanical literature was discussed. These meetings were preceded by a social hour when a repast was served. Here also Dr. Macfarlane showed that delightful geniality so characteristic of this beloved Scot and frequently he recited bits of Scotch poetry and prose in his pleasing native brogue into which he could lapse so readily.

A classical as well as a scientific background in his training, wide experience in the laboratory and in the field and the close association with his fellow man, all gave Dr. Macfarlane a universality of knowledge and a versatility of application seldom found in any one individual. He will be remembered longest as a magnetic teacher, who loved students and who never "talked down" to them but rather on the same plane. Classes coming to him for the first time were usually greeted by "Fellow Students" which would put even the most timid student at ease. He was never too busy to help and to counsel the student. To his colleagues he was ever an inspiring leader. He was an ideal friend and host and the portals of his office and of his home were ever open to all his friends.

Although Dr. Macfarlane carried a heavy teaching schedule, yet he found time for research, writing and publishing more than 140 volumes, monographs and contributions. He was active in research practically to the end of his long and full life, leaving much unpublished work, mainly on taxonomic botany. The unique versatility and ability in his researches are portrayed in the variety of scientific fields which he explored so thoroughly. He held first rank as an authority on insectivorous plants. To cite some of his volumes—as "The Causes and Courses of Organic Evolution," "The Evolution and Distribution of Fishes," "Fishes the Source of Petroleum," "The Quantity and Sources of our Petroleum Supplies," "The Evolution and Distribution of Flowering Plants (Apocynaceae. Asclepiadaceae)"—further shows not only the diversity of his interests but also that he wrote with authority.

Dr. Macfarlane enjoyed membership in many learned societies here and abroad. In addition to the degrees from the University of Edinburgh he held an honorary LL.D., University of Pennsylvania, 1920, and an honorary Litt.D. from LaSalle College, 1929. He was married twice. His first wife, Emily Warburton Macfarlane, died in 1927. His second wife, Lily Wells Macfarlane, survives him, as do four children—Alistair, a teacher in the Philadelphia public schools; Norman, a physician; Archibald, in the State Department, Washington; and Mrs. Winifred Mair, Carlisle, Pa.

WALTER STECKBECK
UNIVERSITY OF PENNSYLVANIA

RECENT DEATHS

DR. HERMAN L. FAIRCHILD, professor of geology emeritus at the University of Rochester, died on November 29. He was ninety-three years old.

DR. FRANK E. LUTZ, chairman and curator of the department of insects and spiders of the American Museum of Natural History, New York City, and since 1909 a member of the scientific staff, died on November 27 at the age of sixty-four years.

ELMER SETH SAVAGE, professor of animal husbandry at Cornell University, died on November 20 at the age of sixty years.

DR. GEORGE H. BURROWS, who retired in 1942 as professor of chemistry and head of the department of the University of Vermont, died on November 22 in his sixty-eighth year. He had served on the faculty for thirty years.

DR. IRWIN BOESHORE, assistant professor of botany at the University of Pennsylvania, died on November

22 at the age of sixty years. At the time of his death he was president of the Botanical Society of Pennsylvania.

FRANKLIN DERONDE FURMAN, who retired in 1941 as professor of mechanism and machine design and dean emeritus of Stevens Institute of Technology, died on November 21. He was seventy-three years old. He served for forty-eight years as a member of the faculty, thirteen years of which he was dean of the college.

MRS. ADELINE DESALE LINK, assistant professor of chemistry at the University of Chicago, died on November 21. She was fifty-one years old.

LIEUTENANT LEONARD A. KEYES, JR., civil engineer, instructor in navigation at Mather Field, California, has been missing since July. Search for the airplane of which he was one of the officers has been abandoned. He was twenty-seven years old and was one of a group studying the latest use of radar in navigation. Colonel John W. Egan wrote to his parents: "Leonard had been on duty with this school for approximately fourteen months, and graduated with the highest honors ever made in the school. The loss of his services will be distinctly felt by the war effort, and extremely difficult to replace." Lieutenant Julian Taylor wrote: "I will say, as any member of the navigation school will say, that, if your son is lost, the navigation school has lost its most brilliant mind. The navigation manual which was to become a permanent navigation text lies half finished for lack of the driving force that was your son."

SCIENTIFIC EVENTS

ENLARGEMENT OF THE LABORATORY STAFF OF THE U. S. FOREST PRODUCTS LABORATORY

THE requirements of the Army and Navy for wood and other forest products and the need for precise study of their properties and uses have been reflected in the quadrupling of the staff of the U. S. Forest Products Laboratory at Madison, Wis., in the past two years. This institution, maintained by the Forest Service of the U. S. Department of Agriculture in cooperation with the University of Wisconsin, is the largest and oldest research organization of its kind in the world. With a background of thirty-three years of experience in wood utilization problems ranging from strength and other analyses of wood properties to the chemical synthesis of wood into new substances of potential value, the Forest Products Laboratory has become established as the nation's center of such knowledge. Since the Pearl Harbor attack, all its resources have been directed toward research and investigations tied directly to the war effort.

Professional personnel was expanded from 91 on July 1, 1941, to 419 on September 30, 1943. The staff on the latter date consisted of forty-two chemists, six chemical engineers, a hundred engineers of other classifications—largely civil, aeronautical and structural—fifty-three technologists, forty-three industrial specialists, seven technical writers, two mathematicians, two physicists and 164 laboratory, engineering and physical science aids. In addition, 249 other employees—administrative, clerical, maintenance and craftsmen—brought the grand total number to 668. Noteworthy in this expansion has been the number of women employees, which increased from thirty-four to 191, including chemists, laboratory aids and other technical workers.

These employees are engaged in a variety of research, test work and consultation for various war agencies. Two entirely new divisions were created and staffed—the Division of Matériel Containers, concerned primarily with testing and designing of better wood and fiber-board containers for the Army Ordnance Department, Army Air Forces, Navy, War Food Administration and similar agencies charged with the packaging and shipment of war matériel of all kinds to overseas fighting fronts; and the Division of Technical Service Training, organized to conduct short specialized courses for Army, Navy and civilian personnel engaged in packaging work, aircraft wood inspection and maintenance of wood aircraft. Major aircraft research programs are being carried out in cooperation with the Army and Navy to develop design data for aircraft parts and set up specifications for wood, plywood, plastics, glues and finishes used in aircraft. The Navy Bureau of Ships is cooperating in a program of research designed to solve many problems of wood use with which it is concerned. Various projects are under way for the War Production Board to find new methods of getting improved service with wood or developing substitutes for other critical materials. Requests for information and testing work are daily received from other Government agencies as well as from many manufacturers confronted with difficult problems of conversion to wood use, ranging from producers of aircraft parts to makers of farm machinery, refrigerators and storage batteries.

THE PACIFIC MAP OF THE NATIONAL GEOGRAPHIC SOCIETY

THE National Geographic Society has issued a new ten-color map of the Pacific Ocean and the Bay of

Bengal. This large wall map not only shows the world's largest and deepest ocean and the war's biggest single arena, but also covers the United States, Australia, half of India, eastern Asia, western South America and parts of Alaska and Canada.

The Pacific Ocean has most of the world's islands. The most important and strategic of these islands are shown on the map by fifty-six large-scale insets. These insets have been chosen to include those islands recently in the news and those expected to be scenes of action soon. Among them are Marcus, Tarawa, Wake, Paramushiro, Nauru, Attu, Kiska, New Britain, Makin, Funafuti, Truk and the Solomons.

Considerably more than half the world is pictured on the map. The Pacific Ocean is twenty-three times as large as the United States. There are fifteen distinct time belts, each belt with a clock at the bottom of the map indicating the local time when it is midnight in Greenwich. The map clearly shows that not all Pacific areas are on an hourly basis in relation to Greenwich. It is 1:22 P.M. in the Cook Islands when it is midnight in Greenwich.

Airline mileages are given, 1,035 of them, in a table of statute or land miles printed on the map. It can be seen at a glance that from Rabaul to Tokyo is 2,870 miles; from Kiska to Paramushiro, 948 miles. Nautical distances from port to port are indicated on the blue-dashed ship lines. Ocean currents are shown in blue-arrowed lines; ocean depth contours in brown lines; winds in brown-arrowed lines. Northern and southern limits of drift ice are indicated.

The map includes the Bay of Bengal, so as to include all possible sources of drives on Tokyo. Motor roads, under construction and completed, from India and Burma to China, are shown. Other important highways are the Russia-to-China desert route and the Alaska Military Highway.

Pre-war political alignments of the many Pacific Islands are identified by color: the traditional red for Great Britain's possessions, purple for France, green for the United States, yellow for the Netherlands, etc. Mandated areas and spheres of influence in the South Pacific are enclosed by red-dotted lines giving the names of the governing powers.

DESTRUCTION OF THE BERLIN HERBARIUM

ANNOUNCEMENT was made in SCIENCE for June 18, 1943, on the basis of private advice received from Sweden, that the herbarium and library of the Berlin Botanical Garden was destroyed by fire in a bombing raid on the night of March 1–2, 1943. This report is now confirmed by information received through the State Department, inquiries having been made at my request through the American legation at Bern, Switzerland. This report, dated September 1, states that the director of the Jardin Botanique at Geneva, Switzerland, has been officially informed that all its material on loan to the Berlin Herbarium was destroyed by fire and water; we may thus assume that all reference collections from American institutions on loan at Berlin were also destroyed. There is no evidence that any attempt was made, in Berlin, to safeguard its especially important botanical material, including its own thousands of types, and types borrowed from foreign institutions, by moving them to a safer place, as was done in London, and as has been done by a number of American herbaria. The loss of the Berlin herbarium is a catastrophe of major proportions to world botany. This herbarium, one of the largest and most important in the world, built up over a period of at least 175 years, contained the basic historical collections of Germany outside of those at Munich. Scores of thousands of type specimens from all parts of the world were thus destroyed.

It seems to be desirable to place on record some data regarding outstanding loans from American institutions in European centers of botanical research as of the present time, including a summary of presumed losses in the Berlin holocaust. I accordingly assembled the data from nine of our largest herbaria. The total losses of these American herbaria in the Berlin disaster are 4,393 specimens, varying from a high of 1,795 from the Gray Herbarium to a low of 164 from the Farlow Herbarium. The total number of specimens now outstanding in European centers is 30,966, with a high of 11,242 from Harvard University (Gray Herbarium, Farlow Herbarium, Arnold Arboretum), to a low of 145 specimens from the Missouri Botanical Garden. The Field Museum of Natural History outstanding loans total 1,567 sheets, the United States National Herbarium 6,807, the New York Botanical Garden, 8,750, the University of California 2,312 and the Missouri Botanical Garden 145; their Berlin loans are Farlow Herbarium 164, Gray Herbarium 1,795, Arnold Arboretum 394, New York Botanical Garden 675, U. S. National Herbarium 993, and the Field Museum of Natural History 373.

That other losses are to be expected is evident from a consideration of the European centers wherein the botanical institutions favored with loans from American institutions are situated, considering the very heavy bombing raids on certain cities in the following list: Berlin, Hamburg, Munich, Vienna, Königsberg, Heidelberg, Giessen, Jena, Breslau, Prague, Budapest, Lund, Stockholm, Uppsala, Utrecht, Leiden, Basel, Leningrad, Copenhagen, Helsinki, Geneva, Paris, Toulouse, Madrid, London, Edinburgh and Birmingham. In the total of 30,966 specimens now on loan from the nine American herbaria to institutions in the above cities, specimens on loan to institutions in

Japan, China, Java and Palestine are not included, and no account has been taken of other loans to various institutions in South America.

Inter-institutional loans of study material have been very largely developed within the present century, and these loans have been reciprocal as between European and other institutions and those in the United States. Under anything approaching normal conditions, losses are very rare, for modern transportation has been found to be safe. While the loss of certain selected collections from American institutions on loan in Berlin will be felt by workers in our herbaria, the really irreplaceable loss is that of the Berlin herbarium itself. Fortunately many of the types of earlier described species in the Berlin collection have been studied by various American botanists and records published; and again, thanks to the initiative of the Field Museum of Natural History, with the support of a grant from the Rockefeller Foundation, 15,800 Berlin types of tropical American species were photographed some years ago, and prints from the negatives may be secured. Thus this photographic record, plus the original descriptions, is now all that is available in thousands of cases to represent the species as originally described. The total number of negatives prepared for the Field Museum representing types and important historical specimens from tropical America in European herbaria is approximately 40,000.

E. D. MERRILL

DIRECTOR, ARNOLD ARBORETUM OF HARVARD UNIVERSITY

MEETINGS OF ENTOMOLOGISTS

THE American Association of Economic Entomologists and the Entomological Society of America are holding in Columbus from December 7 to 9 a conference devoted to "Entomology and the War."

The two groups did not meet last year, but their present responsibilities are such as demand a conference on both health and food problems arising from the war.

According to Professor T. H. Parks, who is chairman of the local committee, the American Association of Economic Entomologists now has 1,575 members who have the responsibility of administering about fifteen million dollars of public funds annually on health, food and shelter problems—most of it on research and control operations.

Topics at the Columbus meeting concern "Medical Entomology in War-time" and "Agricultural Entomology in War-time." Taking part will be specialists in the medical and sanitary work of the U. S. and Canadian armed forces. Chemical control of insects affecting man's health and comfort will be discussed.

Officers of the American Association of Economic Entomologists are P. N. Annand, Washington, D. C., *president;* Avery S. Hoyt, Washington, *vice-president;* Ernest N. Cory, College Park, Md., *secretary-treasurer.*

Officers of the Entomological Society of America are C. P. Alexander, Amherst, *president;* Miriam A. Palmer, Fort Collins, Colo., *first vice-president;* William T. Davis, Staten Island, N. Y., *second vice-president;* and Clarence E. Mickel, St. Paul, Minn., *secretary-treasurer.*

THE INFORMATIONAL SERVICE OF THE DIVISION OF MEDICAL SCIENCES OF THE NATIONAL RESEARCH COUNCIL

PROFESSOR ROSS G. HARRISON, chairman of the National Research Council, has announced the appointment of Major General James Carre Magee, Medical Corps, U. S. Army, retired, as executive officer of the Informational Service of the Division of Medical Sciences. This service has been established by the National Research Council under the recent grant of the Johnson and Johnson Research Foundation, by which the sum of $75,000 was made available to the council for the period ending June 30, 1945. The purpose of the grant is to enable the council to assemble and disseminate, as far as possible, medical information pertaining to the war effort.

General Magee has had a distinguished record in the Medical Corps of the Army. A graduate of Jefferson Medical College in 1905, he has spent his entire professional life in the medical service of the Army. He was assigned to the Philippines before the outbreak of the first World War and then recalled for European duty from 1917 to 1919. He was appointed Surgeon General of the Army in 1939, and on May 31, 1943, he was retired on completion of the four-year term of duty. It was under his direction that the Medical Corps was enormously expanded to meet the demands of the present war and the program of service adopted which has led to the remarkable health record of the Army. General Magee holds the honorary degree of doctor of science from Jefferson Medical College, and was recently awarded the Distinguished Service Medal for outstanding accomplishments as Surgeon General.

General Magee, who assumed his duties on December 1, will devote full time to the organization of a central office in the National Research Council which will collect medical reports and records, widely dealing with military medical practice, civilian practice as affected by the war, medical education and research and the distribution of diseases. The materials collected will, so far as military necessities permit, be made available by publications, summaries and notes.

ROYAL SOCIETY MEDALISTS

THE King of England has approved the recommendations made by the council of the Royal Society for

the award of the two Royal Medals for the current year as follows:

To Sir Harold Spencer Jones, F.R.S., for his determination of the solar parallax and of other fundamental astronomical constants.

To Dr. E. B. Bailey, F.R.S., for his distinguished contributions to the knowledge of mountain structure and his studies on the tectonics of vulcanism.

The following awards of medals have been made by the president and council of the Royal Society:

The Copley Medal to Sir Joseph Barcroft, F.R.S., for his distinguished work on respiration and the respiratory function of the blood.

The Davy Medal to Professor Ian M. Heilbron, F.R.S., for his many notable contributions to organic chemistry, especially to the chemistry of natural products of physiological importance.

The Sylvester Medal to Professor J. E. Littlewood, F.R.S., for his mathematical discoveries and supreme insight in the analytical theory of numbers.

The Hughes Medal to Professor M. L. E. Oliphant, F.R.S., for his distinguished work in nuclear physics and mastery of methods of generating and applying high potentials.

JOHN D. GRIFFITH DAVIES,
Assistant Secretary

SCIENTIFIC NOTES AND NEWS

AT the informal dinner of the National Academy of Sciences on November 22 the Daniel Giraud Elliott Medal for 1937 was presented to Dr. George H. Parker, of Harvard University, and the Mary Clark Thompson Medal for 1941 to Professor D. M. S. Watson, Jodrell professor of zoology and comparative anatomy of University College, London. Since Dr. Watson was unable to be present in person the British Ambassador accepted the invitation of the academy to be its guest and to receive the medal for him.

DR. HENRY VAN DER SCHALIE, assistant curator of mollusks at the museum of zoology of the University of Michigan, has been awarded the Walker Prize of the Boston Society of Natural History. The value of the prize was increased this year from $50 to $100 in recognition of the excellence of Dr. van der Schalie's work on "The Value of Mussel Distribution in the Tracing of Stream Confluence."

DR. HERMAN L. KRETSCHMER, president-elect of the American Medical Association, received on October 18 the honorary degree of doctor of science from the School of Medicine of Marquette University, Milwaukee. He gave the commencement address, which was entitled "Medical Education, the War and You."

THE House of Representatives in anticipation of the fortieth anniversary of the Wright brothers' pioneer flight at Kitty Hawk, N. C., passed and sent to the Senate on November 24 a resolution expressing the nation's "gratitude and respect."

DR. REUBEN M. STRONG, professor of anatomy and chairman of the department at Loyola University School of Medicine, Chicago, and Dr. Thesle T. Job, professor of anatomy, who have completed twenty-five years as members of the faculty, were honored at a dinner given on October 31 by the student body.

HUBERT M. TURNER, associate professor of electrical engineering at Yale University, has been elected president of the Institute of Radio Engineers, an international organization with more than 11,000 members located in all parts of the world.

DR. A. C. FURSTENBERG, dean of the Medical School of the University of Michigan, has been appointed president-elect of the Association of American Medical Colleges. He will assume the presidency in October, 1944.

THE vacancy caused by the sudden death of Sir Beckwith Whitehouse, president of the British Medical Association, has been filled by the appointment of Lord Dawson, who was president at the centenary meeting.

LEWIS M. TURNER, who has been with the U. S. Forest Service since 1937, has become dean of the School of Forestry and Range Management of Utah State College at Logan.

DR. ARTHUR J. GATZ, assistant professor of zoology at Carleton College, has been appointed assistant professor of anatomy in the School of Medicine of Loyola University in Chicago.

DR. CARL E. GUTHE, professor of anthropology and director of museums of the University of Michigan, has been appointed director of the New York State Museum at Albany, N. Y. He will assume his new work on March 1. He succeeds Dr. Charles C. Adams, who retired last summer.

PROFESSOR W. A. SEAMAN, of the Michigan College of Mining and Technology, has been appointed curator of the mineralogical museum named after his father, the late Professor A. E. Seaman, who contributed greatly to its establishment more than fifty years ago. The museum contains 20,000 display specimens representing more than 1,100 of the 1,600 recognized mineral species. Its nucleus consists of gifts made in the 1880's and 1890's by Dr. Lucius L. Hubbard, Dr. George A. Koenig and Professor A. E. Seaman, who was head of the department of geology of the college from 1899 to 1928 and who served as

curator of the museum from 1928 to 1937, the year of his death.

THE Norwich Pharmacal Company has made an appropriation of $2,500 to establish two fellowships at Syracuse University for work on antibacterial agents under the direction of Dr. P. M. Ruoff. The fellowships have been awarded to R. D. Sprenger and F. W. Staab.

DR. GEORGE K. ANDERSON, technical aide of the Division of Medical Sciences of the National Research Council, Washington, D. C., has become secretary of the Council on Foods and Nutrition of the American Medical Association.

DR. HAROLD S. ADAMS, general superintendent of the Upjohn Company, has been elected a vice-president. Dr. E. Gifford Upjohn has been appointed medical director.

DR. DAVID A. KRIBS, assistant professor of botany of the Pennsylvania State College, has been appointed director of research and head of the school for wood airplane construction, designed for engineers and supervisors in inspection and production, of the Fairchild Aircraft, Burlington, N. C.

DR. JOSEPH C. BEQUAERT and Dr. Everett P. Veatch, of the American Foundation of Tropical Medicine, left on November 16 by plane for Liberia to make a study of the incidence of sleeping sickness among the natives of northeast Liberia and French and British Guiana.

THE British Ministry of Agriculture, according to *The Times*, London, has selected the following delegates to visit the United States to report on American farming conditions and their lessons for British agriculture: Tom Peacock, a former president of the National Farmers' Union; F. Rayns, executive officer of the Norfolk War Agricultural Executive Committee, and A. R. Wannop, North of Scotland Agricultural College.

DR. HARVEY N. DAVIS, head of the Office of Production Research and Development, which operates under the War Production Board in Washington, and Dr. Donald B. Keyes, chief of the chemical industries branch, are on a mission to Great Britain. They will discuss with the Ministry of Production and other Government departments the exchange of technical information between the two countries, and they hope to encourage experts on both sides of the Atlantic to inspect each other's factories and factory operations.

DR. CLARENCE C. LITTLE delivered on November 16 the annual Barnard Free Skin and Cancer Hospital Lecture before the St. Louis Medical Society. He spoke on the "Influence of Heredity in Human Cancer."

EARLY in November Dr. Carl G. Hartman, head of the department of zoology and physiology and chairman of the Biological Division of the University of Illinois, delivered a series of lectures in California. Before the Pacific Coast Society of Obstetrics and Gynecology, meeting in San Francisco, he spoke on "Recovery of Primate Eggs and Embryos" and on "Regenerative Capacity of the Monkey Uterus"; at the Institute of Experimental Biology, University of California, Berkeley, on "Some New Cell Types in the Vaginal Smear of the Rat"; before the Research Club, Stanford University, on "Instinctive Behavior as Illustrated by the Solitary Wasp" (with motion pictures); before the Los Angeles Gynecological Society, on "The Normal and the Hyperactive Ovary in the Menstrual Cycle and in Hyperplasia."

APPLICATIONS for research fellowships in medicine, dentistry and pharmacy in the University of Illinois are now being considered for the year beginning September 1, 1944. Appointments to these fellowships will be announced on January 1. Candidates must have completed a training of not less than eight years beyond high-school graduation. The fellowship carries a stipend of $1,200 per calendar year with one month's vacation. Application blanks and further information may be secured from the Secretary of the Committee on Graduate Work in Medicine, Dentistry and Pharmacy, 1853 West Polk Street, Chicago 12, Illinois.

THE Society of the Sigma Xi will hold its forty-fourth annual convention on December 4, in Chicago at the Shoreland Hotel. Due to wartime conditions, the necessary business of the society, with ninety chapters in institutions of higher learning and forty alumni clubs in leading cities, will be confined to a single day. Attendance will be limited to delegates from chapters and clubs. Petitions for the establishment of Sigma Xi chapters at five more universities will be received and acted upon at the national convention. Charters are being requested for chapters at Emory University, Atlanta; North Carolina State College, Raleigh; St. Louis University; Vanderbilt University, and Wayne University, Detroit. Dr. Harlow Shapley, president of the society and director of Harvard College Observatory, delivers the twenty-second annual lecture on December 3, in the University of Chicago's Mandel Hall, speaking on "Star Clusters and the Dimensions of the Galaxies." Dr. Anton J. Carlson, who is the Hixson distinguished service professor of physiology, emeritus, at the University of Chicago, makes the introduction.

THE autumn meeting of the Utah Academy of Science, Arts and Letters was held at the Utah State Agricultural College on November 13. A special feature of the program was an address on "Experimental

Nutritional Deficiencies" by Dr. M. M. Wintrobe, head of the department of internal medicine of the University of Utah. Addresses at the general sessions were made also by Dr. N. A. Pedersen, dean of arts and sciences, Utah State Agricultural College; by Dr. E. E. Erickson, dean of arts and sciences of the University of Utah; by Dr. A. M. Woodbury, professor of biology, University of Utah, and by Dr. O. W. Israelsen, professor of irrigation and drainage, Utah State Agricultural College. Twenty-one contributed papers were read at three sectional meetings. The officers of the academy for the current year are: *President,* R. H. Walker, dean of agriculture and director of the Agricultural Experiment Station, Utah State Agricultural College; *First Vice-president,* Walter P. Cottam, professor of botany, University of Utah; *Second Vice-president,* Vasco M. Tanner, professor of zoology, Brigham Young University, and *General Secretary,* I. O. Horsfall, director of the Extension Division of the University of Utah.

THE National Malaria Society met conjointly with the Southern Medical Association in Cincinnati, from November 16 to 18, under the presidency of Brigadier General James S. Simmons, M. C., A. U. S. A Symposium on the National Program for the Control of Malaria was held on November 18. The following officers were elected to serve during 1944: *Honorary President,* Dr. Frederick L. Hoffman, Los Angeles; *President,* G. H. Bradley, Atlanta; *President-elect,* H. A. Johnson, Memphis; *Vice-president,* Stanley Freeborn, Atlanta; *Secretary-Treasurer,* Dr. Mark F. Boyd, Tallahassee; *Member of the Editorial Board,* Dr. Lloyd Roseboom, Baltimore, and *Representative to the Council of the American Association for the Advancement of Science,* Dr. E. C. Faust, New Orleans.

AT the sixteenth annual meeting of the Central Society for Clinical Research held in Chicago on November 5, the following officers were elected for the year 1943–44: *President,* Dr. Cecil J. Watson, Minneapolis; *Vice-president,* Dr. Willis M. Fowler, Iowa City; *Secretary-Treasurer,* Dr. Carl V. Moore, St. Louis. *Councilors:* Drs. Harold Feil, Cleveland; F. W. Madison, Milwaukee; Ovid O. Meyer, Madison; Irvine H. Page, Indianapolis; William A. Thomas, Chicago, and John W. Scott, Lexington.

CLIFTON E. MACK, director of procurement, U. S. Treasury Department, will speak at the annual luncheon meeting of the American Standards Association to be held on December 10 at the Hotel Roosevelt. His address will deal with using standards to bring government requirements more nearly into line as a part of the American industrial system. Mr. Mack is in charge of all government lend-lease purchasing. This meeting marks the twenty-fifth anniversary of the founding of the American Standards Association. Started as a result of the production problems of the last war, the association has in the past year completed more than forty emergency jobs for the armed services and industry, and is engaged on many others. R. E. Zimmerman, president of the organization, will give a brief address on post-war changes and developments. H. S. Osborne, chairman of the Standards Council, will report on the year's work. Because of the special nature of this occasion, in commemoration of its twenty-five years of service to industry and government, the American Standards Association extends a cordial invitation to all who wish to attend, whether they are members of the association or not. Further information in regard to the meeting may be obtained from the American Standards Association, 29 West 39th St., New York 18, N. Y.

THE Long Island Biological Association, Cold Spring Harbor, N. Y., has received from Mrs. Henry W. deForest, in addition to her gift of nine acres with buildings and her interest in the Sand Spit, a deed to some seven acres of land, adjacent to the first parcel, on which stands a residence which will serve as the home of the director of the laboratory.

THE *Journal* of the American Medical Association reports that a Frank Wister Thomas professorship of medicine will be established at the School of Medicine of the University of Pennsylvania under the will of Mrs. Maria G. B. Thomas of Philadelphia, who died on September 15. The professorship will be a memorial to Mrs. Thomas's husband, Dr. Frank W. Thomas, who died on January 19, 1928. According to the will, most of the $200,000 estate is left ultimately to create the new chair. The residue is bequeathed to the university toward the endowment, and trust funds amounting to $50,000 will be added to it as the beneficiaries die, until $200,000 is accumulated. The holder of the professorship shall be the person who is recognized by the trustees as the head or chief professor of medicine at the medical school. If the endowment exceeds the amount necessary to establish the professorship, or if the chair becomes temporarily vacant, one or more temporary Frank Wister Thomas fellowships in medicine will be set up. Any excess over the $200,000 limit fixed for the professorship is bequeathed to Germantown Dispensary and Hospital.

THE *Journal* of the American Dental Association states that a list of minimum standards for dental departments in hospitals has been established by the American College of Surgeons. This list supplements the fifteen minimum standards already established for distinct hospital services and departments and is a part of the hospital standardization program of the American College of Surgeons.

DISCUSSION

ANGIOTONIN OR HYPERTENSIN

IN a letter to SCIENCE, Page, Helmer, Plentl, Kohlstaedt and Corcoran[1] suggest the term "renin substrate" (α 2 globulin) for hypertensinogen or renin-activator. Uniformity of terminology would be desirable, as it has become rather confusing, due to the fact that some substances have several names as follows:

Buenos Aires group	*Indianapolis group*	*Lewis and Goldblatt*[4]
Hypertensin	Angiotonin	Hypertensin
Hypertensinogen	Renin-activator	Hypertensinogen
Hipertensinase	Angiotonase[2]	Hypertensinase
No equivaent	Angiotonin-activator[3] Angiotonin-inhibitor[3] Renin-inhibitor[3]	No equivalent

The last three terms have no equivalent in the Buenos Aires group terminology because the existence of the substances or actions implied have not been conclusively proved.

As to which term should be used, angiotonin or hypertensin, it is a matter of personal judgment. No priority can be claimed by either group, as the discovery of this substance was practically simultaneous.

The objection against hypertensin because it "implies a participation in hypertension and an effectiveness in hypotension" would perhaps be valid for commercial use, a point which we have never considered. The term hypertensin appropriately describes its action of increasing blood pressure and, as Lewis and Goldblatt[4] point out, "if it is eventually proved" to be the "cause of the elevated blood pressure, then the specific term hypertensin . . . will be more pertinent than the non-specific term angiotonin." That it has a definite and important participation in renal experimental hypertension is, we believe, unquestionable.

The terminology of the Buenos Aires group "in which renin the enzyme acts on hypertensinogen . . . to liberate hypertensin(e) the vasoconstrictor (and pressor), which may be destroyed by hypertensinase, has a clarifying unity which, in a sense, is lacking to the parallel succession of renin, renin activator, angiotonin and angiotonin inhibitor."[5] To us it has the advantage of being simple, logical, of forming a homogeneous group and of describing the action or origin of the substances.

[1] I. H. Page, O. M. Helmer, A. A. Plentl, K. G. Kohlstaedt and A. C. Corcoran, SCIENCE, 98: 153, 1943.
[2] I. H. Page, O. M. Helmer, K. G. Kohlstaedt, G. F. Kempf, A. C. Corcoran and R. D. Taylor, *Ann. Int. Med.*, 18: 29, 1943.
[3] I. H. Page and O. M. Helmer, *Jour. Exp. Med.*, 71: 495, 1940.
[4] H. A. Lewis and H. Goldblatt, *Bull. N. Y. Acad. Med.*, 18: 459, 1942.
[5] Editorial. *Jour. Am. Med. Asn.*, 120: 923, 1942.

The term renin-activator should be abandoned because it conveys an erroneous idea. The term hypertensinogen is perfectly correct: in fact, the suffix "ogen" is used to denote "giving rise to" (glycogen gives glucose, fibrinogen, fibrin, caseinogen, casein, etc.). As to the new term proposed "renin substrate (α 2 globulin) it should be pointed out: (1) that the enzymatic nature of the reaction has not "been established beyond a doubt."[1] There are several facts which make it probable, as we have repeatedly pointed out. But the matter can only be settled by experimenting with known concentrations of the pure substances. The fact that reaction approximately follows the equation for a first order reaction[6] can not be taken as a proof. (2) Moreover, if renin is really an enzyme, it might act on more than one substrate. For instance, pepsin acts on many proteins and calling one of them pepsin substrate would not identify it. (3) Adding another term (α 2 globulin) which describes its electrophoretic behavior would not help much. Moreover, it is not yet known whether hypertensinogen is all or part of the α 2 globulin fraction of serum, or only accompanies this fraction, and it remains to be proved that this fraction always contains hypertensinogen.

The addition of a new long and not too happy term for a substance, which has already four, would hardly simplify the terminology.

E. BRAUN MENENDEZ
J. C. FASCIOLO
B. A. HOUSSAY
L. F. LELOIR
J. M. MUÑOZ
A. C. TAQUINI

THE TRIPTANE PROCESS

TRIPTANE is the most powerful hydrocarbon known for use in internal combustion engines. Its antiknock properties are of such magnitude that no commercial engine has been built which is capable of utilizing the full power value of pure triptane. When used as a component of aviation gasoline, it greatly enhances the performance of present-day aircraft engines and makes possible the design of future engines of even greater power and efficiency.

Although its existence has been known for years and some of its physical properties have been determined, triptane has been a laboratory curiosity because the known methods of producing it involved the classical but impractical Grignard reaction, or zinc di-methyl as a reactant. Reported costs for producing triptane in very small amounts in the laboratory by

[6] A. A. Plentl and I. H. Page, *Jour. Biol. Chem.*, 147: 135, 1943.

these methods have run to such fantastic figures as over $3,000.00 per gallon. It has been reported that a batch of several hundred gallons of triptane was produced within the past two years for experimental purposes at a reported figure of $40.00 per gallon. Even if the cost did not preclude the use of triptane for war purposes, the consumption of critical materials needed to produce it by previously known methods would not justify its production.

The authors, working with materials at hand and available in quantity, made the discovery which makes possible the commercial production of this fuel. They, together with the technical staff of the Universal Oil Products Company, made possible the production of triptane at an estimated selling price of less than $1.00 per gallon.

The process consists of two steps. The second step of the process involves the formation of triptane from a selected charging stock produced in the first step. Based on the material charged to the second step, liquid recoveries of over 90 per cent. are obtained of which over 50 per cent. is triptane.

The process, when operated to make the largest quantity of triptane available as a blending agent, yields two other valuable hydrocarbons, in themselves of great value in aviation blends. These hydrocarbons, 2,3-dimethylbutane and 2,3-dimethylpentane, are superior to alkylate as blending agents for aviation gasoline.

Table 1 gives the physical properties of individual hydrocarbons produced by this process:

TABLE 1

Compound	B.P., °C.	M.P., °C.	Refractive index. nD^{20}	Specific gravity
2,3-dimethylbutane ..	58.0	−128.8	1.3750	0.6620
2,2,3-trimethylbutane (triptane) .	80.8	− 25.0	1.3894	0.6901
2,3-dimethylpentane ..	89.7	....	1.3920	0.6944

The relatively high freezing point of pure triptane does not preclude its use in aviation fuels. Blends containing up to about 85 per cent. triptane do not freeze above −78° C. (−108° F.).

The product of the reaction is saturated and free of impurities so that no additional refining treatment is necessary to permit its use in aviation fuels. The process has been operated to date for 300 hours in a pilot plant with no indication of decline of catalyst activity.

No new or unusual materials are needed for the reaction or process. The raw materials are condensable gases produced in petroleum refineries as by-products of catalytic and non-catalytic cracking or reforming of petroleum oils. The catalysts are readily available in large quantities. No special equipment or materials used in the process plant are necessary other than regular equipment employed in refineries. The temperatures and pressures employed are well within refinery experience.

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CONCERNING TRANSLATIONS OF GEOLOGICAL TEXTS FOR SOUTH AMERICAN STUDENTS

IN a recent issue of SCIENCE (September 3) there is a letter concerning the translation of American textbooks of geology for use in South America. It would be very fine to have two or three with which I am well acquainted translated, but I would make the suggestion that, if this were done, illustrations from South America be included. That means that some one from one of the South American universities should work in collaboration with the translator.

I also wish to call the attention of those who might be interested in this subject to the fact that there is a very excellent two-volume work on the geology of Argentina by Windhausen, in Spanish. I consider this an excellent book, and I doubt if the people in Argentina would prefer a translation of a North American text to this one.

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SCIENTIFIC BOOKS

CHEMICAL SPECTROSCOPY

Chemical Spectroscopy. By PROFESSOR WALLACE R. BRODE. Second edition. xi + 677 pp. Illustrated. New York: John Wiley & Sons. $6.50.

THE second edition of this book closely follows the general plan of the first. All phases of spectroscopy are considered, as the chapter headings show. The illustrations are very numerous, and some which were indistinct in the first edition are now very satisfactory; *e.g.*, Fig. 3.35, p. 64; Fig. 4.2, p. 71; Fig. 4.7, p. 86. Some of the photographs of apparatus, too, are clearer.

The valuable lists of references have been brought up to date; it is interesting that a total list of 239 references in the first edition is now expanded to 415.

The book will be of particular use to the practical man, and to him it can be warmly recommended. Theoretical discussions are less happily dealt with, however. At the opening of the chapter on "Resonance and Chemical Structure," a preliminary discussion of resonance is given which can convey but very little to those unacquainted with the subject, since no adequate definition or description of resonance is given. After a digression in which the electronic

eory of valency is reviewed, a definition of resonance provided which is open to serious objections.

It is implied—particularly in the use of the expression "equilibrium mixture"—that distinct molecular pecies corresponding to the extreme electronic formulae of resonating compounds are capable of independent existence.

The word resonance undoubtedly suggests some kind of rapid oscillation or vibration to many people. Nevertheless, no such change, quick or slow, is actually present, and a resonating compound is not a mixture. It seems unfortunate to add to the confusion by using the word "vibrator" (p. 259) for a part of a molecule which is capable of resonance.

The reader is cautioned against confusing resonance with tautomerism (p. 137), yet a typical tautomeric equilibrium is given in Fig. 6.11c (p. 143) as an example of resonance. Similar confusion is reflected in Fig. 8.41. In Fig. 6.11c, too, the equation purporting to show resonance within the molecule of quinone is obviously incorrect; the dipolar structure shown has two positive charges.

The relationship implied by the caption for Fig. 8.29 is at variance with the text. If the unsymmetrical dye shows a deviation in λ max., it would absorb at some shorter wave-length than the mean of the values of λ max. of the related symmetrical dyes, whereas the caption is so worded that the unsymmetrical dye appears to absorb at *longer* wave-length than either of the symmetrical dyes. Actually none of these curves is that of a dye which contains a thiazole ring; they are the spectra of 1,1′-diethyl-2,2′-, 2,4′- and 4,4′-carbocyanine iodides, taken in the order A, B, C. Incidentally, the term "degeneracy" is used in Fig. 8.30 where "deviation" is meant.

Aside from these criticisms, however, this volume contains such a wealth of material that it may confidently be expected to appeal to a wide circle of readers.

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TEMPERATURE

Temperature Measurement. By Robert L. Weber. Frontisp., x + 171 + 6 pp.; 3 pls. Ann Arbor, Mich.: Edwards Brothers, Inc. $2.50. 1941.

The scope of the book is considerably broader than the title indicates; it might better have been called "Heat Measurements." There are chapters on heat transfer, radiation, calorimetry, thermal analysis and elementary thermodynamics. From the outside reader's point of view this is a defect, for none of these subjects can be treated in such brief chapters in more than a very condensed and—for the elementary student—inadequate way. On the other hand, the author, who is on the teaching staff of the School of Chemistry and Physics of Pennsylvania State College, may have found that his students were not getting, from other physics courses, a point of view or insight that he wished them to have on some of these subjects, and may have inserted them for local and practical reasons. Thirty pages are devoted to laboratory experiments intended for instruction.

The chapters that do hew to the line cover expansion thermometry, resistance thermometry, thermo-electric pyrometry, radiation (including optical) pyrometry, special methods of temperature measurement, measurement of extreme temperatures, the International Scale, temperature recorders and temperature control. The chapter on control, six pages long, can hardly do more than tell the student that there is such a thing as automatic control and hint at its complexity. It is a subject still badly in need of a good write-up.

The job of offset printing from typescript copy is quite satisfactory with the exception of illustrations of the half-tone variety, which are not well adapted to this method of reproduction.

This looks like a book that will be useful to any teacher or student concerned with measurements of energy and temperature.

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SPECIAL ARTICLES

DESTHIOBIOTIN[1]

During the work leading to the proof of structure of biotin,[2] a procedure devised for the hydrogenolysis of organic sulfides[3] was applied to biotin methyl ester.[4] The resulting product was named *desthiobiotin* methyl ester, and was formed from biotin methyl ester by the replacement of the sulfur atom in the molecule

[1] The authors wish to thank Dr. R. T. Major and the Research Staff of Merck and Company, Incorporated, for supplies of biotin. The authors also wish to express their appreciation to Dr. J. R. Rachele and R. C. Funk, Jr., for the microanalyses, and to Miss Carol Tompkins and Mrs. Glenn Ellis for technical assistance in the bioassays.

[2] V. du Vigneaud, Science, 96: 455, 1942.

[3] R. Mozingo, D. E. Wolf, S. A. Harris, and K. Folkers, *Jour. Am. Chem. Soc.*, 65: 1013, 1943.

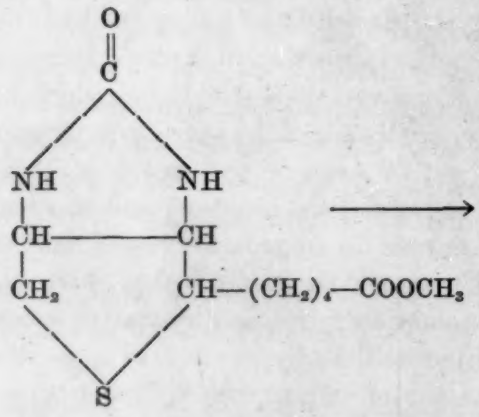
[4] V. du Vigneaud, D. B. Melville, K. Folkers, D. E. Wolf, R. Mozingo, J. C. Keresztesy and S. A. Harris, *Jour. Biol. Chem.*, 146: 475, 1942.

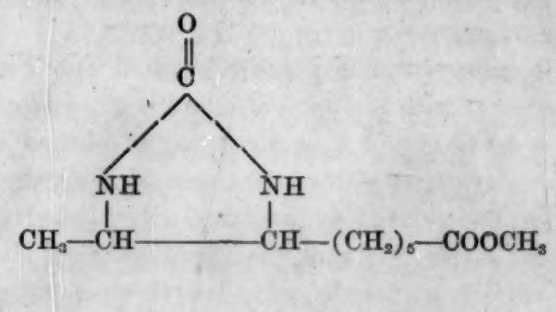
by two hydrogen atoms, as indicated by the accompanying structures.

Vigorous treatment of desthiobiotin methyl ester with acid or alkali yielded ζ,η-diaminopelargonic acid which by treatment with phenanthrenequinone yielded the same quinoxaline derivative as synthetic ζ,η-diaminopelargonic acid.[4]

In line with our study of the relationship of structure to the biological activity of biotin, which we have under way, an investigation of the biological effects of desthiobiotin was undertaken. While all phases of the investigation of this compound are not yet complete, we feel it worthwhile to make a preliminary report at this time, in view of the surprising yeast-growth activity of this compound. We have found that desthiobiotin is equally as effective as biotin in stimulating the growth of *Saccharomyces cerevisiae*, and produces a readily noticeable growth effect in a concentration of less than 1 part in 400,000,000,000.

The previously published method[4] of preparing desthiobiotin methyl ester by refluxing an alcoholic





solution of biotin methyl ester with Raney nickel for several hours was found unsatisfactory for the preparation of the pure compound. Various samples of desthiobiotin methyl ester prepared in this manner showed differences in melting point and varying degrees of biological activity. Separation from undesirable side-products was difficult. In no case did we obtain a product with an activity approaching the activity reported here for the pure product. Treatment of biotin (free acid) under the same conditions was equally unsatisfactory.

We have now found that by carrying out the desulfurization of biotin in aqueous *alkaline* solution and for a short period of time, excellent yields of pure desthiobiotin can be obtained. In this way we have prepared desthiobiotin of constant melting point and biological activity. The compound was characterized by analysis and by conversion to ζ,η-diaminopelargonic acid.

50 mg of biotin were dissolved in 15 cc of 0.5 per cent. Na_2CO_3, and approximately 2.5 gm of Raney nickel[3] prepared at 50° were added. The mixture was heated with continuous stirring at 75° for 15 minutes. At the end of this time, the nickel was centrifuged down and washed with 2 cc of 0.5 per cent. Na_2CO_3 solution and twice with 2 cc of water. The combined solutions were acidified to Congo red with HCl and concentrated to 2–3 cc. Fine needles separated from the solution during the last stages of concentration. These were removed and washed with water. This fraction, micro m.p. 152–7°, weighed 36 mg. By concentration of the mother liquors and then continuous ether extraction for 5 hours an additional 6 mg, m.p. 147–152° were obtained. Two recrystallizations of the crude desthiobiotin from water yielded the pure compound, m.p. 157–8°.

$C_{10}H_{18}O_3N_2$ 214.3	Calculated,	C 56.04,	H 8.47,	N 13.08
	Found,	" 56.30,	" 8.58,	" 13.12

The desthiobiotin was tested for its biotin activity by the yeast-growth method of biotin assay,[5] in which Strain 139 *Saccharomyces cerevisiae* was used. Under our conditions of assay, both biotin and desthiobiotin produced similar growth curves with a half-maximum growth increase at a concentration of 1 part in 4.75×10^{10}. Desthiobiotin is therefore, on a weight basis, fully as active as biotin for this strain of yeast. On a molarity basis, desthiobiotin, because of its slightly lower molecular weight, is somewhat less effective than biotin as a yeast-growth factor.

In conformity with our hypothesis that the urea grouping of biotin is essential for the combination of biotin with avidin,[6] we find that the yeast-growth activity of desthiobiotin is also inhibited by avidin.

That such a deep-seated change in the structure of the biotin molecule should result in a compound of such a high order of biological activity is indeed surprising. However, that desthiobiotin can not replace biotin in the media for all micro-organisms which require biotin is demonstrated by our finding that desthiobiotin does not stimulate the growth of *Lactobacillus casei*. The effect of desthiobiotin on various other

[5] E. E. Snell, R. E. Eakin and R. J. Williams, *Jour. Am. Chem. Soc.*, 62: 175, 1940.

[6] V. du Vigneaud, K. Dittmer, K. Hofmann and D. B. Melville, *Proc. Soc. Exp. Biol. and Med.*, 50: 374, 1942.

micro-organisms and on mammals and birds remains to be investigated.

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RATIONS FOR THE STUDY OF THE RELATIVE NUTRITIVE VALUE OF FATS AND OILS

DATA have shown butter fat to have superior growth-promoting value for the albino rat as compared to certain vegetable oils: (1) on a diet of mineralized raw skimmed milk into which the various fats and oils have been homogenized;[1] (2) on a basal diet of ether-extracted mineralized skim milk powder[2]; and (3) on a synthetic type ration containing *lactose 32*, casein (fat free) 28, liver extract 1–20[3] 6, salts 6, fat 28, and vitamins.[2]

Since at the present time there is great interest in the nutritional value of fats, we felt that our data would be of aid to workers in the field. In the present study weanling albino male rats of the Sprague-Dawley strain were given *ad libitum* a basal diet of the following composition: *lactose 48*, casein (fat free) 20, fat 28 and salts IV[4] 4 per cent., respectively. Vitamins added per 100 gm of ration: thiamine 0.5 mg; riboflavin 0.5 mg; nicotinic acid 0.625 mg; pyridoxine 0.625 mg; calcium pantothenate 5.0 mg; p-amino benzoic acid 30.0 mg; inositol 100 mg; choline 250 mg; β-carotene 0.56 mg; α-tocopherol 2.24 mg; calciferol 0.014 mg; and 2-methyl-1, 4-naphthaquinone 0.21 mg. The results recorded in Table 1 show the average number of grams gained during the period of six weeks by rats fed butter fat or corn oil on both the 32 per cent. lactose ration[2] and on the 48 per cent. lactose ration. Rough and discolored fur coats, blood-stained noses and scaly paws (when the humidity was not abnormally high) were noted in the rats fed the 48 per cent. lactose ration containing corn oil. Thus greater differences were found between the nutritive value of butter fat and corn oil in the young rapidly growing rat when the lactose content of the ration was raised from 32 to 48 parts, and the liver concentrate was omitted entirely.

TABLE 1

	32 per cent. lactose ration	48 per cent. lactose ration		
Experiment No.	53, 54, 62	78	81	84
No. of rats on each fat	15	6	6	6
Butter fat. Gain in six weeks	197 gm	164 gm	174 gm	156 gm
Corn oil. Gain in six weeks	168 gm	124 gm.	131 gm	118 gm
Difference	29 gm	40 gm	43 gm	38 gm

TABLE 2

Diet exclusive of fat	Fat	Average gain in gm in six weeks
Skim milk powder 70	Butter fat 30	219*
Skim milk powder 70	Corn oil 30	200*
Difference		19
Skim milk powder 50, lactose 20	Butter fat 30	214
Skim milk powder 50, lactose 20	Corn oil 30	172
Difference		42
Skim milk powder 50, dextrose 20	Butter fat 30	221
Skim milk powder 50, dextrose 20	Corn oil 30	217
Difference		4

* Average of 12 male rats.

Likewise, an increased level of lactose on a skim-milk powder basal ration accentuates the difference in the nutritive value of butter fat and corn oil. The ration was prepared as described,[2] and the experiment set up as shown in Table 2. These data represent the average growth over a six-week period by six male rats, in each group.

It is apparent that lactose has an as yet unknown effect on intestinal conditions which is counteracted by butter fat but not by corn oil.

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[3] A fat-free water extract. One part equals twenty parts of whole fresh liver.

[4] P. H. Phillips and E. B. Hart, *Jour. Biol. Chem.*, 109: 657, 1935.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE FRACTIONAL CEPHALIN-CHOLESTEROL FLOCCULATION TEST

IN a recent communication, Bruger[1] proposed a fractional cephalin-cholesterol flocculation test to be used as an index of increasing or decreasing hepatic pathology. The modification consisted in the utilization of increasing dilutions of serum with saline and noting the flocculation according to the procedure originally described by Hanger.[2] The data presented

[1] E. J. Schantz, C. A. Elvehjem and E. B. Hart, *Jour. Dairy Science*, 23: 181, 1940.

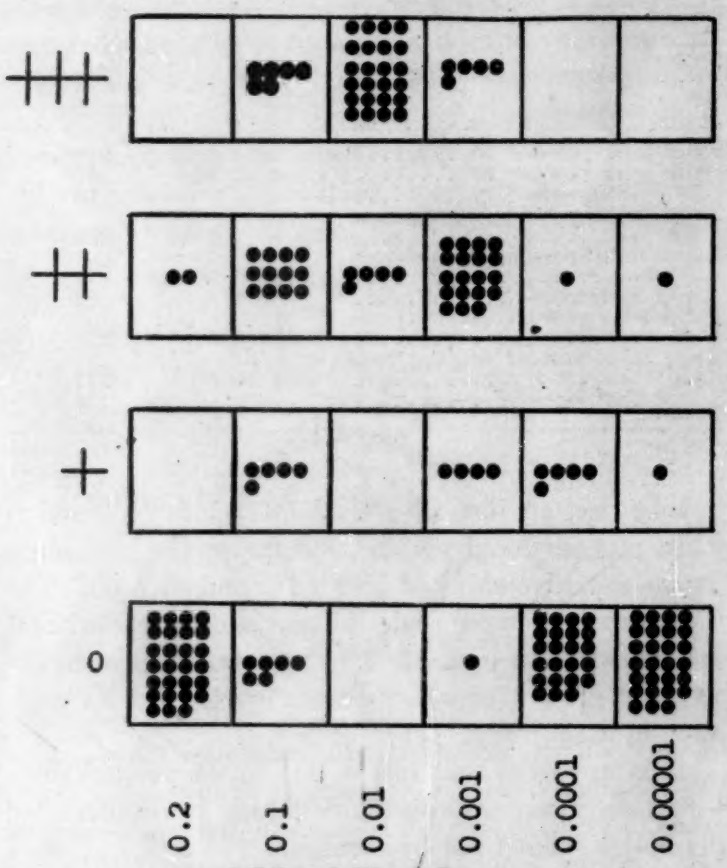
[2] R. K. Boutwell, R. P. Geyer, C. A. Elvehjem and E. B. Hart, *Jour. Dairy Science*, 26: 429, 1943.

[1] M. Bruger, SCIENCE, 97: 585, 1943.

in support of the modified test does show that, when repeated at various intervals, changes occur which could be interpreted as indicative of increasing or decreasing dysfunction.

In the application of a similar procedure to routine studies, we studied a series of normal individuals, using the proposed fractional test.[3] It was noted that, whereas with 0.2 cc of undiluted blood serum a negative reaction would occur in nearly every instance, a positive reaction was noted when 0.1 cc of saline-diluted serum or less was employed (Fig. 1). This

FLOCCULATION AT VARIOUS DILUTIONS OF SERUM WITH SALINE



was particularly the case with greater dilutions of serum with saline, so that with 0.01 cc of diluted serum a definitely positive reaction usually occurred.

Accordingly, it is obvious that the fractional cephalin-cholesterol flocculation test by means of serial saline dilutions of blood serum is not a valid procedure for following alterations in hepatic function.

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[2] F. M. Hanger, *Jour. Clin. Invest.*, 18: 261, 1939.

[3] We are indebted to Dr. David Klein, The Wilson Company, for generous supplies of a standardized Cephalin-Cholesterol mixture.

A TECHNIQUE FOR DIFFERENTIATING THE CELLS OF THE PITUITARY OF THE RAT

IT is well known that procedures worked out for staining human tissues do not always give good results when used on animal tissues. In connection with some work done in this department it was necessary to devise a stain to differentiate the acidophils and basophils of the pituitary of the rat. Mallory connective tissue stain, using the procedure described in Mallory, "Pathological Technique," does not give satisfactory differentiation, but the adaptation here described, using somewhat different dye concentrations, different staining times and a different staining temperature, has given excellent results. The procedure is as follows:

Fixation: Fix in Helly's fluid and imbed in paraffin. Cut sections 4 micra in thickness.

Staining: (Note: Control each step under the microscope; all times given are average).

(1) Stain approximately 5 minutes in a 0.1 per cent. (aqueous) solution of acid fuchsin.

(2) Wash in water, then differentiate 1–2 minutes in water containing 8 drops glacial acetic acid per 100 cc.

(3) Aniline blue stain

Aniline blue (w.s.)	0.5 gm
Orange G	1.3 "
Phosphotungstic acid 1 per cent. (aqueous) solution	100.0 cc

Stain at 35–40 degrees C for 10–15 minutes. Wash off excess stain in water.

(4) Dehydrate quickly in 95 per cent. and absolute alcohols. Clear in xylol, mount in balsam.

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BOOKS RECEIVED

BINING, ARTHUR CECIL. *The Rise of American Economic Life.* Illustrated. Pp. xii + 732. Charles Scribner's Sons.

BISHOP, SHERMAN C. *Handbook of Salamanders.* Illustrated. Pp. xiv + 555. Comstock Publishing Company. $5.00.

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